

vary with individual birds (Dunstan and Sample 1972; Eckert and Karalus 1974).

On four occasions during our half-hour search, the female glided downward, distances ranging from 20 to 60 m, to alternate perches about 3 to 6 m high in other trees partially hidden from our view by foliage. Immediately upon landing on the perch either facing us or facing away, she spread and quivered both wings and simultaneously uttered a series of chitters and squeals resembling those generally made by begging young. This behavior lasted only 5 to 10 s, after which she crouched on the branch with her wings kept partially opened. When we approached within 20 m of her, the owl returned to one of several high perches located in a central area of roughly 2500 m².

Although we are both experienced field observers, we were fooled on the first two occasions into thinking she had led us to a nest of young or to one of her fledglings begging for food. An intensive search of the area surrounding these perches revealed neither of these and thereafter we restricted our search to the central area. The following day three young Barred Owls were discovered perched high in the trees in the same area occupied by the adult female the previous day.

Injury-feigning displays designed to draw intruders away from young have been cited by Bent (1938) for

Great Horned Owls (*Bubo virginianus*), Snowy Owls (*Nyctea scandiaca*), Long-eared Owls (*Asio otus*), and Short-eared Owls (*Asio flammeus*), but these displays have never been reported for Barred Owls (M. Fuller, T. Dunstan, personal communication).

Of further interest here, however, is that the distraction display was not of an injury-feigning nature, but appeared to simulate the feeding of a young bird by the parent. One other distraction display is reported by Eckert and Karalus (1974) for the Long-eared Owl, that is that the parent attempts to draw intruders away from its young by noisily pretending to catch and kill "some kind of bird as prey." Only additional observation on distraction displays on any owl species can serve to clarify these behavioral phenomena.

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Natural History of Rock Voles (*Microtus chrotorrhinus*) in Minnesota

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Abstract. A population of rock voles, *Microtus chrotorrhinus*, which inhabited a large bed of boulders in northeastern Minnesota, was studied in August 1975. The voles did not occupy the entire boulder field, but rather appeared to be restricted to a narrow transition zone between the open rocks and mature forest. An interconnecting system of runways was found in the crevices beneath and between the boulders. Litter size averaged 3.5, with some females producing at least three litters during the breeding season. Females born in late spring produced litters during their first summer. Notes on food habits, activity, parasites, cranial measurements, and associated species are included.

The rock vole, *Microtus chrotorrhinus*, occurs from the Ungava Peninsula to the southern Appalachian Mountains, and west along the northern shores of the Great Lakes to Minnesota (Hall and Kelson 1959). Rock voles are restricted to moist rocky habitats in the Canadian and Hudsonian life zones (Kirkland 1977; Linzey and Linzey 1971; Martin

1971a; Doult et al. 1973; Timm 1974), or more rarely to openings in moist forest (Goodwin 1929; Kirkland 1977). Prior to this study, the rock vole was known in Minnesota from one specimen taken in 1921 near Burntside Lake, St. Louis County (Swanson 1945; Handley 1954), and two taken in 1973 in Cook County (Timm 1974).

Study Area and Methods

The study area was a long, narrow boulder field, approximately 1.2 km long and 120 m wide, located in sections 19, 20, and 29 of T. 64 N, R. 1 E, Cook County, Minnesota. This open boulder field crosses County Road 12 at 27 km N and 2 km W of Grand Marais, Minnesota, and lies at an elevation of approximately 540 m in a broad valley between two low hills. Frost action associated with retreat of glaciers from this area approximately 9000 years BP (Before Present) is thought to have been responsible for the development of the bed of granophyre and gabbro boulders. Timm (1975) summarized details of climate, vegetation, and mammals in Cook County.

The center of the boulder field consisted of exposed rocks occasionally interspersed with small "islands" of shrub vegetation. Dominant vegetation in open rock areas consisted of dry lichens and reindeer moss (*Cladonia*). The forest surrounding the rock bed was dominated by aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), and black spruce (*Picea mariana*). Young balsam fir (*Abies balsamea*) also was common. Thimbleberry (*Rubus parviflorus*), Clinton's lily (*Clintonia borealis*), bunchberry (*Cornus canadensis*), wild lily-of-the-valley (*Maianthemum canadense*), and large-leaved aster (*Aster macrophyllus*) were the most common herbs. The transition zone between open rocks and forest, ranging from 5 to 10 m in width, was dominated by woody vegetation from 1 to 3 m in height. Especially common in this zone were alder (*Alnus*), willow (*Salix bebbiana*), honeysuckle (*Diervilla lonicera*), serviceberry (*Amelanchier*), and young balsam fir. Several small plants, especially rose (*Rosa acicularis*), blueberry (*Vaccinium angustifolium*), Clinton's lily, bunchberry, wild lily-of-the-valley, twin-flower (*Linnaea borealis*), and black spruce were common. Boulders covered with moss and leaf litter extended well into dense forest, indicating that the size of the open boulder field has diminished with vegetational succession. Standing water was visible under a small part of the boulder field.

Two hundred museum special mouse-traps and 50 Sherman live-traps were baited with peanut butter and oatmeal, and checked four times daily 8–12 August 1975. The 24 rock voles and representatives of all other species trapped were prepared as study specimens and deposited in the Bell Museum of Natural History, University of Minnesota (MMNH).

Results and Discussion

Habitat Selection

All rock voles taken during this study were captured in the boulder field; nearly all were captured in the transition zone between open rocks and mature forest.

Within this zone most were trapped below the rock surface in cavities between boulders. These cavities were partially filled with soil and were connected to the rock surface and to each other by runways. The southern red-backed vole, *Clethrionomys gapperi*, was the only other small mammal captured in subsurface runs. The pronounced preference of rock voles for the transition zone probably was due to availability of both preferred food and nesting sites. The subsurface environment presumably assisted in avoidance of both predators and extreme weather conditions. One trap set about 25 cm below the surface captured three adult rock voles, indicating multiple use of runways.

Reproduction

Eleven of 13 adult and subadult females were active reproductively; at least two of these were young-of-the-year as indicated by body size and cranial characters. A mean litter size of 3.5 ($N=13$) was estimated from counts of embryos, corpora lutea associated with unimplanted embryos, and recent placental scars (see Table 1). These results are similar to data presented by Martin (1971a) and Coventry (1937), who found mean litter sizes of 3.7 and 3.6, respectively.

Proportionately fewer males than females in our sample were sexually active. Four of the 11 males trapped were in breeding condition as judged by size of the testes and development of the epididymides and seminal vesicles. Average length and width of the testes of these four animals were 12.8 and 7.5 mm, body weight ranged from 32.7 to 43.7 g, and the smallest specimen was 150 mm in total length. The seven non-reproductively active males (testes length \times width $\leq 5 \times 3$ mm) varied in weight from 16.2 to 24.8 g. None had a total length greater than 150 mm.

Timm (1975) reported that deer mice, *Peromyscus maniculatus*, southern red-backed voles, and meadow voles, *Microtus pennsylvanicus*, started breeding in Cook County in May of both 1972 and 1973 and that females of the latter two species may have three litters during the summer. Evidence of three pregnancies (see Table 1) in two large female rock voles in our sample indicated that May or June also may be a typical time for initiation of breeding by rock voles at this locality.

Food Habits

Most blueberry bushes (both leaves and stems) and Clinton's lily plants along the narrow margin of the boulder field where rock voles were trapped were heavily browsed by rodents, as indicated by tooth marks. A smaller proportion of wild lily-of-the-valley, bunchberry, and mushrooms appeared to have been

TABLE 1—Reproductive characteristics of 11 subadult and adult female rock voles from Cook County, Minnesota, collected in August of 1973 and 1975. Code abbreviations are as follows: embs (embryos), CL (corpora lutea associated with unimplanted ova), RS (recent placental scars), OS (old placental scars), L (left uterine horn), R (right uterine horn). Animals are listed in decreasing order of size

Catalog number	Total length (mm)	Weight (g)	Number of pregnancies	Litter size	Comments
12266	160	33.0	2	3RS (1L×2R) 4OS (2L×2R)	Trapped from same locality in August 1973
12996	158	46.0	3	4CL (1L×3R) 5RS (4L×1R) 5OS (2L×3R)	
12986	156	40.0	3	CL (unknown #) 3RS (2L×1R) 6OS (3L×3R)	Well developed mammary tissue
12985	152	34.9	2	3CL (2L×1R) 4RS (2L×2R)	Lactating
12979	152	26.5	2	4 embs (3L×1R) 4OS (2L×2R)	
12998	147	39.5	2	4 embs (3L×1R) OS (unknown #)	CL associated with embryos = 2L×1R; thus, possibly a case of polyembryony
12982	147	28.3	2	3CL (3R) 3OS (2L×1R)	Well developed mammary tissue
12997	146	36.4	2	3 embs (2L×1R) OS (unknown #)	1 resorbing embryo L
12978	145	—	2	3 embs (1L×2R) 5OS (4L×1R)	Well developed mammary tissue
12983	143	29.6	1	3RS (2L×1R)	Well developed mammary tissue
12981	133	19.1	1	3CL (1L×2R)	

browsed. Grass was less common and showed little evidence of being grazed. Three rock voles carried plant material in their mouths when captured; one had the partial leaf of a forb, one carried two seeds and a bud, and the third was carrying 3- to 5-cm clippings of fresh grass. Captive rock voles consumed blueberry (stems, leaves, and ripe berries), leaves of Clinton's lily and wild lily-of-the-valley, bunchberry (leaves and ripe berries), and ripe raspberry (*Rubus strigosus*), but showed little interest in fresh grasses from the site of capture. A captive subadult male readily consumed all insects presented to him, suggesting that the rock vole may be omnivorous rather than strictly herbivorous as previously believed.

Activity Patterns

Goodwin (1929) and Martin (1971a) stated that rock voles are active primarily during daylight hours.

This apparently was not the case during our study: of 21 individuals trapped on 9 and 10 August, 7 (33%) were taken between 2300 and 0700 hours (33% of the day); 4 (19%) between 0700 and 1200 hours (21% of the day); 2 (10%) between 1200 and 1800 hours (25% of the day); and 8 (38%) between 1800 and 2300 hours (21% of the day). Timm (1974) reported capturing one rock vole from this population in the early evening and another in the early morning. Thus, it appears that rock voles are active throughout the day and night, but less active during afternoon hours, at least in northern Minnesota during August.

Parasites

Parasites collected from rock voles during this study include mites, *Laelaps kochi* and *Haemogamasus ambulans* (Thorell, 1872) [= *H. alaskensis* Ewing, 1925]; chiggers (*Neotrombicula microti* and

Neotrombicula harperi); ticks (*Ixodes angustus*); and tapeworms (Cestoda: Hymenolepididae). This record represents the first time *Neotrombicula microti* has been identified as being parasitic on rock voles. Timm (1974) also reported two species of fleas (*Peromyscopsylla catatina* and *Megabothris quirini*) and one species of mite (*Laelaps alaskensis*) parasitizing rock voles at this locality.

Cranial Measurements

Selected cranial measurements (mean and range in millimetres) for four adult females followed by those of four adult males are as follows: greatest length of skull 26.4 (26.2–26.6), 27.1 (26.8–27.4); zygomatic breadth 14.6 (14.4–14.7), 15.1 (14.4–15.6); inter-orbital constriction 3.6 (3.5–3.6), 3.7 (3.5–3.7); length of nasal bones 7.4 (7.2–7.5), 7.6 (7.4–7.9); length of maxillary toothrow 6.2 (5.8–6.4), 6.3 (6.2–6.5). These measurements are larger than corresponding measurements reported by Komarek (1932) for specimens of the same subspecies, *M. chrotorrhinus chrotorrhinus*, from the eastern part of their range.

Associated Species

Nine other mammalian species (followed by the number of each trapped) were taken from the study area in 1975: short-tailed shrew, *Blarina brevicauda* (1); eastern chipmunk, *Tamias striatus* (1); least chipmunk, *Eutamias minimus* (7); red squirrel, *Tamiasciurus hudsonicus* (1); deer mouse (6); southern red-backed vole (48); meadow vole (2); southern bog lemming, *Synaptomys cooperi* (5); and ermine, *Mustela erminea* (1). Timm (1974) also captured the arctic shrew (*Sorex arcticus*), masked shrew (*S. cinereus*), and woodland jumping mouse (*Napaeozapus insignis*) at this site. Several mink, *Mustela vison*, were sighted in the vicinity in 1973 and 1975.

The presence of four species of microtine rodents at this site is of interest in regard to competition and competitive exclusion in small mammals. Martin (1971b) found no reports of the meadow vole in habitat occupied by the rock vole. Our two meadow voles were non-breeding subadult males and were trapped in the open rocks. Breeding populations of meadow voles apparently occur in the area and individuals disperse to the rock outcrops, but meadow voles have not successfully colonized the boulder field.

Five southern bog lemmings were trapped in the transition zone and adjacent mature forest. One of these was removed from a trap at which a rock vole and a southern red-backed vole had been captured previously. The presence of a pregnant adult female suggests a resident population of southern bog lemmings at the site, and indicates at least some overlap of habitat use by bog lemmings and rock

voles. Southern bog lemmings appear to have a broader habitat range, utilizing forest areas as well as the transition zone.

The southern red-backed vole was an abundant small mammal both in the preferred habitat of the rock vole and in the adjacent forest. It was the only other microtine taken from subsurface runs, and in at least three instances was taken from traps that also caught rock voles. In addition to being active at the same time, red-backed voles probably eat many of the same foods, and breeding by the two species takes place during the same times of the year. No fighting occurred in laboratory investigations of behavior using a single subadult male rock vole and three adult red-backed voles, but the rock vole appeared to be dominant. Red-backed voles were aggressive when handled however, whereas rock voles were docile.

Conclusions

The ecology of the rock vole suggests several questions for future investigation. Because all populations of rock voles reported seem to be small and isolated from other populations, it would be especially interesting to examine patterns of genetic variability. What allows rock voles to compete successfully with several other microtine rodents, especially red-backed voles, which appear to occupy a similar niche in this environment? Is their non-aggressive behavior and low litter size a response to a relatively stable and predator-free subterranean living situation? Do they show cyclic patterns of population fluctuation?

The rock vole is rare and remains poorly known in Minnesota. As the forest encroaches upon the rock bed, habitat available for rock voles is slowly decreasing; however, a more immediate threat to the population is destruction of habitat for timber harvest. Steps should be taken to insure that this site is protected and that scientific investigations on this population be conducted in such a manner as not to threaten its future.

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Disorientation in Ringed and Bearded Seals

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The phenomenon of seals lost on land or unable to find access to the water through the frozen ice cover is well documented for some antarctic localities (Stirling and Rudolph 1968; Stirling and Kooyman 1971). Although it is common knowledge among the Inuit that seals get lost, few reports exist of such occurrences for the Arctic. Freuchen and Salomonsen (1958) and Freuchen (1935) note that walrus (*Odobenus rosmarus*) and ringed seals (*Phoca hispida*) sometimes get caught out of the water by freezing ice. This note documents several instances where both live or dead ringed seals and bearded seals (*Erignathus barbatus*) have been found on the land or away from access to water. Data were collected over an 8-year period in the Home Bay region, east Baffin Island, and in the Holman region on the west coast of Victoria Island, Northwest Territories.

Ringed Seals

On the Sea Ice

June 1968. During a hunt of hauled-up seals on the flat ice northeast of Ekalugad fiord (68°40' N, 65°10' W) the trail of a lost seal was found. By following the tracks for approximately 1.6 km over the flat sea ice, we located and collected a ringed seal pup (0+ years).

14 June 1972. A track was followed for at least 6.6 km until

the ringed seal pup (0+) was found on the flat sea ice near Iluvilik (70°30' N, 116°30' W) southeast of Holman, Northwest Territories.

Late April or early May 1973. Approximately 25 km to the west of Holman (70°57' N, 118°25' W) on the shoreline, an adolescent ringed seal was found. The track of the seal was found on the ice, trailing inland for a short distance and then returning to the sea ice. The land at this location rises as a gentle slope from the ocean. This area of shoreline also shows a consistent opening and closing of tidal cracks during the fast-ice season. The seal had apparently been out of the water for some time, since its hindquarters were frozen. The ventral skin surface was badly worn indicating that the animal had travelled a considerable distance. There was some evidence of bite marks in the axilla and on the hind flippers.

On the Land

5 May 1972. A yearling male ringed seal was sighted approximately 18 km inland northwest of Holman (70°47' N, 117°49' W) near Okotitak Lake. The seal was alive and still moving. It had very badly worn areas of skin ventrally. Another seal was found crossing Irkaharvik Lake (70°52' N, 117°56' W) approximately 17 km inland northeast of the village of Holman. The exact year of occurrence is not remembered but the seal was found in late March or early April.

Early June 1973. A live adolescent ringed seal was found approximately 150 m inland on the south shore of Prince